INTEGRATED CIRCUITS

DATA SHEET

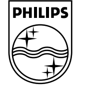
TEA5591A

AM/FM radio receiver circuit

Product specification
File under Integrated Circuits, IC01

February 1990

Philips
Semiconductors





GENERAL DESCRIPTION

The TEA5591A is a 24-pin integrated radio circuit, derived from the TEA5591 and is designed for use in AM/FM portable radios and clock radios. The TEA5591A differs from the TEA5591 in that it has:

- Separate IF input pins for AM and FM
- A split-up AM-IF stage (for distributed selectivity)
- An LED driver indicator

The main advantage of the TEA5591A is its ability to operate over a wide range of supply voltages (1.8 to 15 V) without any loss of performance.

The AM circuit incorporates:

- A double balance mixer
- A ‘one-pin’ oscillator with amplitude control operating in the 0.6 to 30 MHz frequency range
- A split-up IF amplifier
- A detector
- An AGC circuit which controls the IF amplifier and mixer.

The FM circuit incorporates:

- An RF input amplifier
- A double balanced mixer
- A ‘one-pin’ oscillator
- Two IF amplifiers (for distributed selectivity)
- A quadrature demodulator for a ceramic filter
- Internal AFC

Features

- LED AM/FM indicator
- A DC AM/FM switch facility
- Three separate stabilizers to enable operation over a wide range of supply voltages (1.8 to 15 V)
- All pins (except pin 10) are ESD protected

PACKAGE OUTLINE

24-lead shrink DIL; plastic (SOT234); SOT234-1; 1996 September 9.

QUICK REFERENCE DATA

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage (pin 8)		V_P	1.8	–	15	V
Total current consumption						
AM part		I_P	–	14	–	mA
FM part		I_P	–	17	–	mA
Operating ambient temperature range		T_{amb}	–15	–	+ 60	°C
AM performance (pin 1)	note 1					
Sensitivity	V_o = 10 mV	V_i	–	3.5	–	µV
	(S + N)/N = 26 dB	V_i	–	17	–	µV
Signal-to-noise ratio	V_i = 1 mV	(S + N)/N	–	48	–	dB
AF output voltage		V_o	–	45	–	mV
Total harmonic distortion		THD	–	0.7	–	%
Signal handling	m = 80%; THD = 8%	V_i	–	100	–	mV
FM performance (pin 2)	note 2					
Limiting sensitivity	–3 dB	V_i	–	2.3	–	µV
Signal-to-noise ratio	V_i = 2.5 µV	(S + N)/N	–	26	–	dB
	V_i = 1 mv	(S + N)/N	–	60	–	dB
AF output voltage		V_o	–	90	–	mV
Total harmonic distortion		THD	–	0.8	–	%
Signal handling		V_i	–	100	–	mV
AM suppression	100 µV < V_i < 100 mV	AMS	–	40	–	dB

Notes to the quick reference data

1. All parameters are measured in the application circuit (see Fig.4) at nominal supply voltage V_p = 3 V; T_{amb} = 25 °C; unless otherwise specified. RF conditions: Input frequency 1 MHz; 30% modulated with f_{mod} = 1 kHz; unless otherwise specified.
2. All parameters are measured in the application circuit (see Fig.4) at nominal supply voltage V_P = 3 V; T_{amb} = 25 °C; unless otherwise specified. RF conditions: Input frequency 100 MHz; frequency deviation Δf = 22.5 kHz and f_{mod} = 1 kHz; unless otherwise specified.

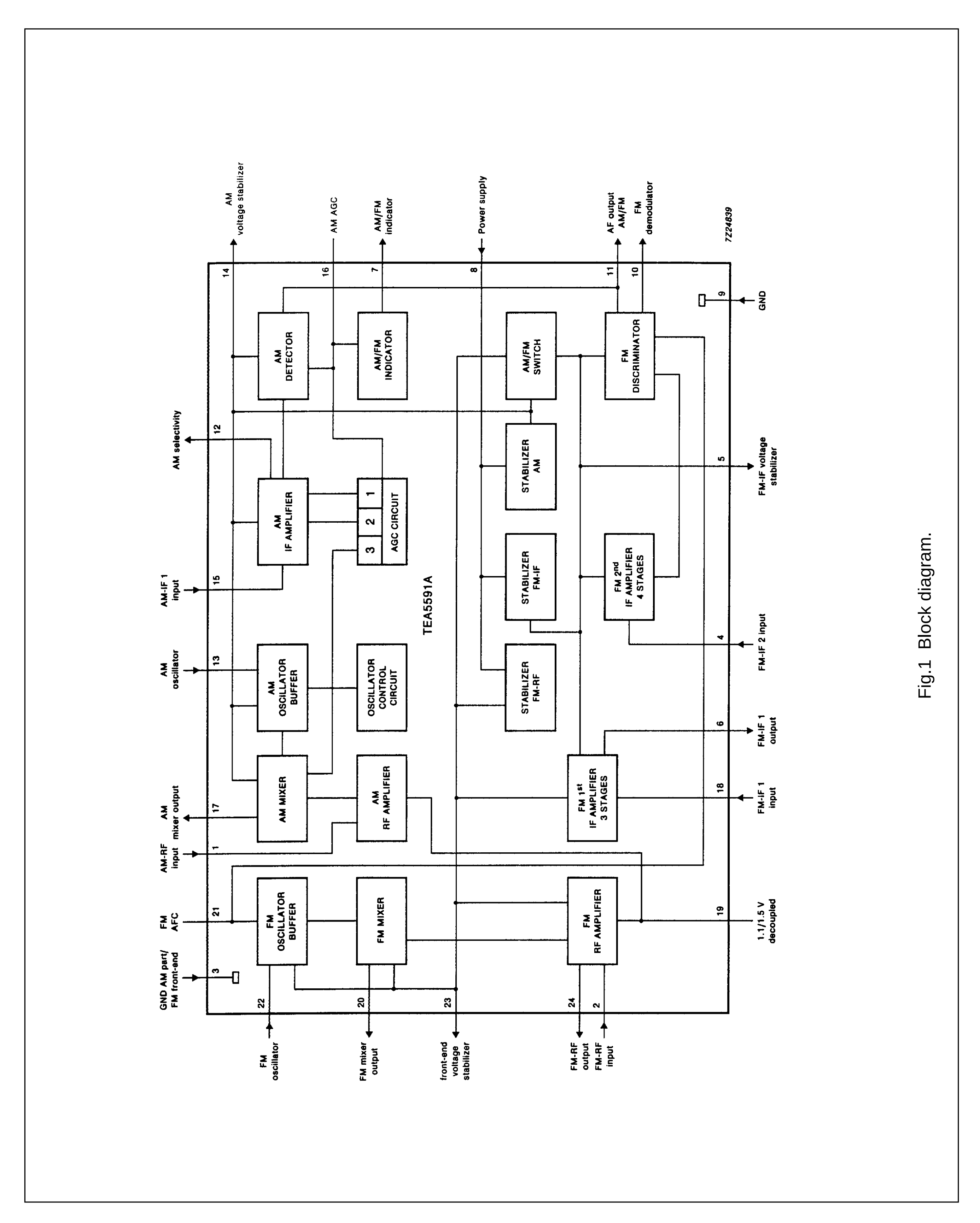


Fig.1 Block diagram.

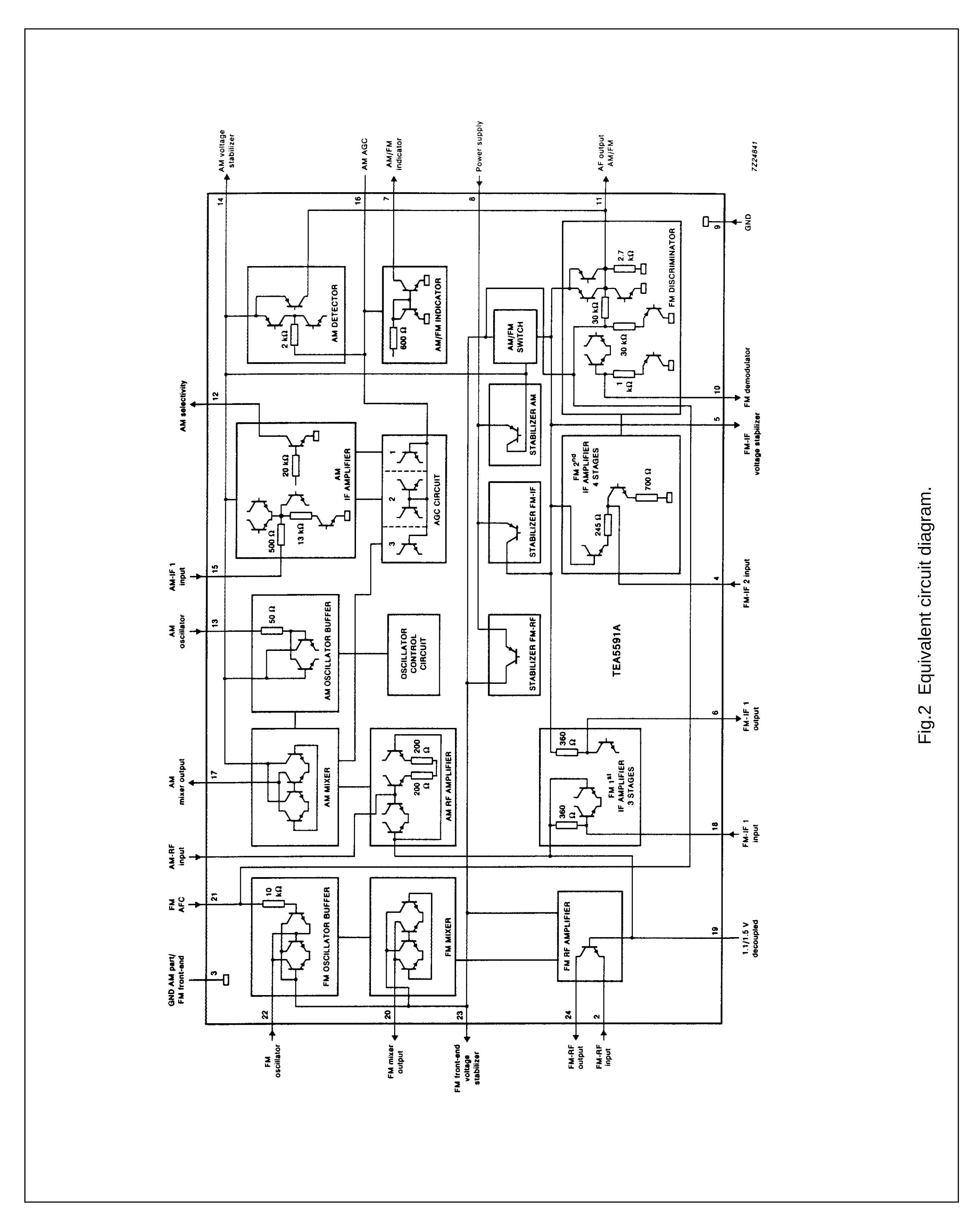


Fig.2 Equivalent circuit diagram.

PINNING

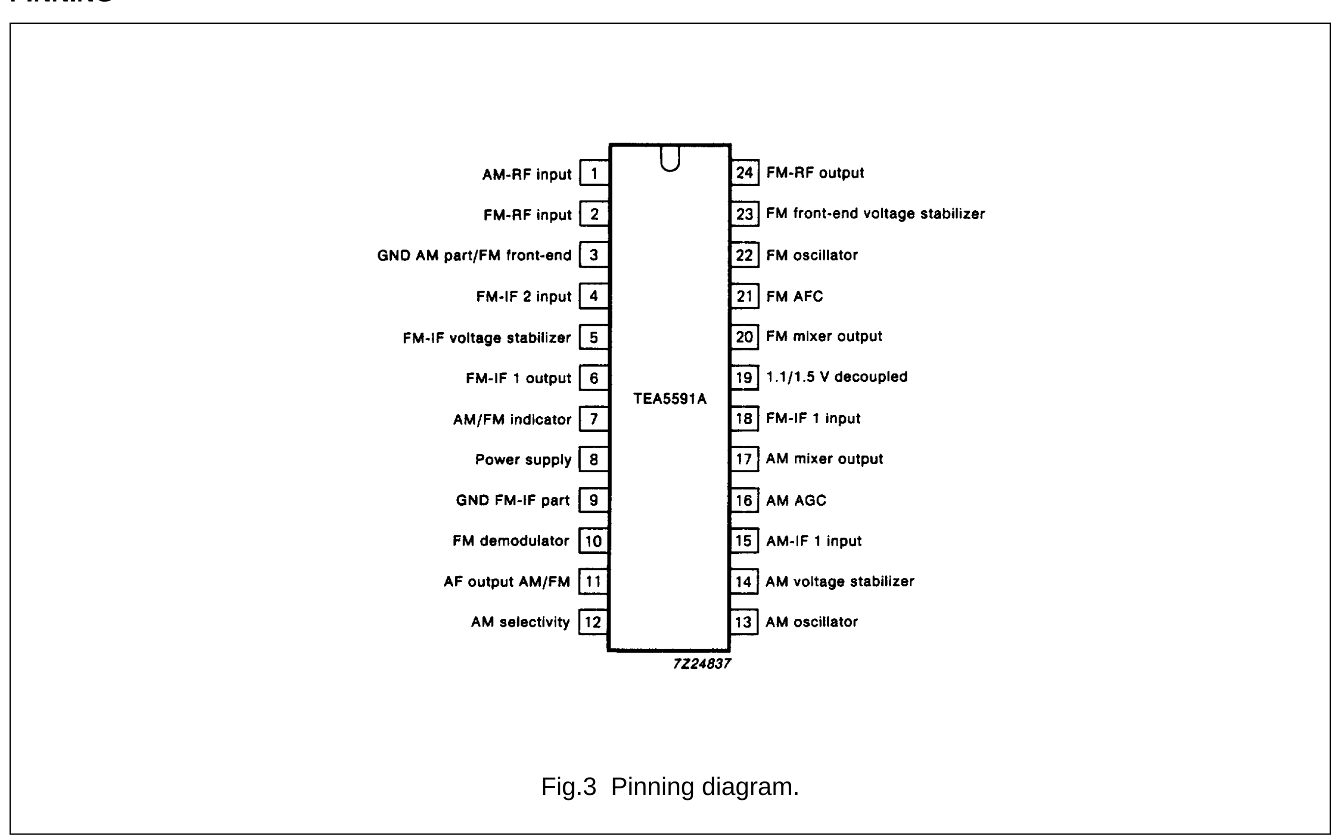


Fig.3 Pinning diagram.

RATINGS

Limiting values in accordance with the Absolute Maximum System (IEC 134)

PARAMETER	SYMBOL	MIN.	MAX.	UNIT
Supply voltage (pin 8)	V_P	–	18	V
LED current (pin 7)	I_7	–	tbf	mA
Total power dissipation	P_{tot}	see Fig.4		
Storage temperature range	T_{stg}	–65	+150	°C
Operating ambient temperature range	T_{amb}	–15	+60	°C
Electrostatic handling(1)	V_{es}	–1000	+1000	V

Note

1. Equivalent to discharging a 100 pF capacitor through a 1500 Ω series resistor.

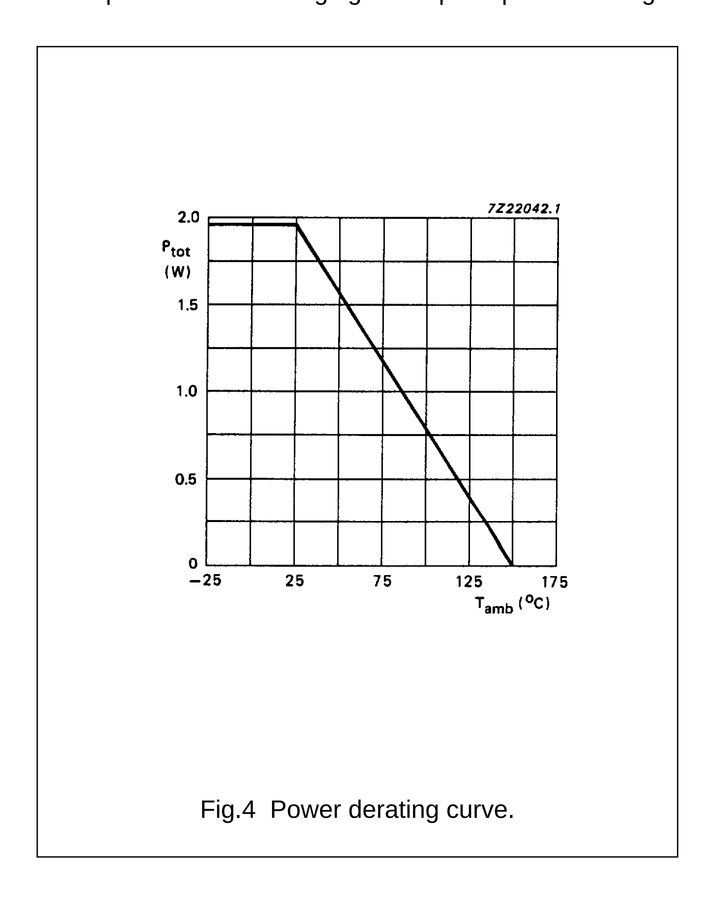


Fig.4 Power derating curve.

DC CHARACTERISTICS

All voltages are referenced to pin 3 and pin 9; all input currents are positive; all parameters are measured in test set-up (see Fig.6) at nominal supply voltage V_P = 3 V; T_{amb} = 25 °C unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Supply voltage		V_P	1.8	3.0	15	V
Voltages (FM)						
pin 2		V_2	–	0.90	–	V
pin 4		V_4	–	0.85	–	V
pin 5		V_5	–	1.60	–	V
pin 6		V_6	–	1.48	–	V
pin 10		V_{10}	–	1.05	–	V
pin 18		V_{18}	–	1.60	–	V
pin 19		V_{19}	–	1.58	–	V
pin 21		V_{21}	–	0.69	–	V
pin 23		V_{23}	–	1.60	–	V
Voltages (AM)						
pin 14		V_{14}	–	1.60	–	V
pin 16		V_{16}	–	1.54	–	V
pin 19		V_{19}	–	1.10	–	V
Total current consumption	note 1					
AM part		I_P	–	14	19	mA
FM part		I_P	–	17	23	mA

Note to the DC characteristics

1. Without LED current.

AC CHARACTERISTICS

All parameters are measured in test set-up (see Fig.6) at nominal supply voltage V_P = 3 V; T_{amb} = 25 °C unless otherwise specified

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
AM part						
AM front end						
(pin 1 to 17)	note 1					
Conversion						
transconductance	V_i = 10 mV V_{AGC} (pin 16) = V_{14} – 0.1 V	S_C	9.3	12	13.5	mA/V
	V_i = 10 mV V_{AGC} (pin 16) = V_{14} – 0.45 V	S_C	0.75	1.1	1.3	mA/V
IF suppression	note 2 V_i = 10 mV	α	20	26	–	dB
Oscillator (pin 13)						
Voltage	f = 1.5 MHz	V_{osc}	110	175	200	mV
	f = 1.5 MHz V_P = 1.5 V	V_{osc}	60	160	–	mV
IF and detector part						
(pin 15 to 11)	note 3					
IF sensitivity;						
AF output voltage	no AGC; V_i = 45 μV	V_o	12	20	55	mV
Signal + noise to noise						
ratio for an IF input	no AGC; V_i = 45 μV	S + N/N	23	25	–	dB
AF output voltage	V_i = 1 mV	V_o	35	45	60	mV
Total harmonic	V_i = 10 mV					
distortion	m = 80%	THD	–	1	2.2	%
LED-indicator circuit						
(pin 7)						
Output current	V_i = 0 V	I_{ind}	–	(8)	(8)	μA
	V_i = 1 mV	I_{ind}	(8)	(8)	–	mA
Overall performance						
(pin 1 to 11)	note 4					
Total harmonic						
distortion	V_i = (8) mV	THD	–	4.5	8	%
FM part						
FM frond end						
(pin 2 to 20)	note 5					
Conversion						
transconductance	V_i = 1 mV	S_C	7.5	11	13.5	mA/V

PARAMETER	CONDITIONS	SYMBOL	MIN.	TYP.	MAX.	UNIT
Oscillator (pin 22)						
Voltage	V_{AFC} (pin 21)					
	= 0.8 V	V_{osc}	155	200	245	mV
	V_{AFC} = 0.8 V					
	V_P = 1.5 V	V_{osc}	60	120	–	mV
AFC control; change in						
oscillator frequency	V_{AFC} = 0.8 V	f	–	111.2	–	MHz
	ΔV_{AFC} = –0.6 V	Δf	–	+420	–	kHz
	ΔV_{AFC} = +0.6 V	Δf	–	–620	–	kHz
IF and demodulator part						
(pin 18 to 11)	note 6					
IF sensitivity;	note 7					
AF output voltage	V_i = 100 μV	V_o	–3	–1	0	dB
Signal + noise to noise						
ratio for an IF input	V_i = 100 μV;					
	out of limiting	S + N/N	26	30	–	dB
AF output voltage	V_i = 1 mV	V_o	75	90	120	mV
Total harmonic	Δf = 75 kHz					
distortion	V_i = 50 mV	THD	–	3	–	%
LED-indicator circuit						
(pin 7)						
Output current	V_i = 0 V	I_{ind}	–	–	20	μA
	V_i = 1 mV	I_{ind}	0.6	1	1.9	mA

Notes to the AC characteristics

1. Input frequency = 1 MHz; output frequency = 468 kHz.
2. $\alpha = \frac{(V_o \text{ at } f_i = 1 MHz)}{(V_o \text{ at } f_i = 468 kHz)}$.
3. Input frequency = 468 kHz; m = 30% modulated with f_{mod} = 1 kHz; unless otherwise specified.
4. Front-end connected to IF plus detector part. Input frequency = 1 MHz; m = 80% modulated with f_{mod} = 1 kHz.
5. Input frequency = 100 MHz; output frequency = 10.7 MHz.
6. Input frequency = 10.7 MHz; frequency deviation, Δf = 22.5 kHz and f_{mod} = 1 kHz; unless otherwise specified.
7. Reference: AF output voltage = 0 dB at V_i = 1 mV.
8. Value to be fixed.

APPLICATION AND TEST INFORMATION

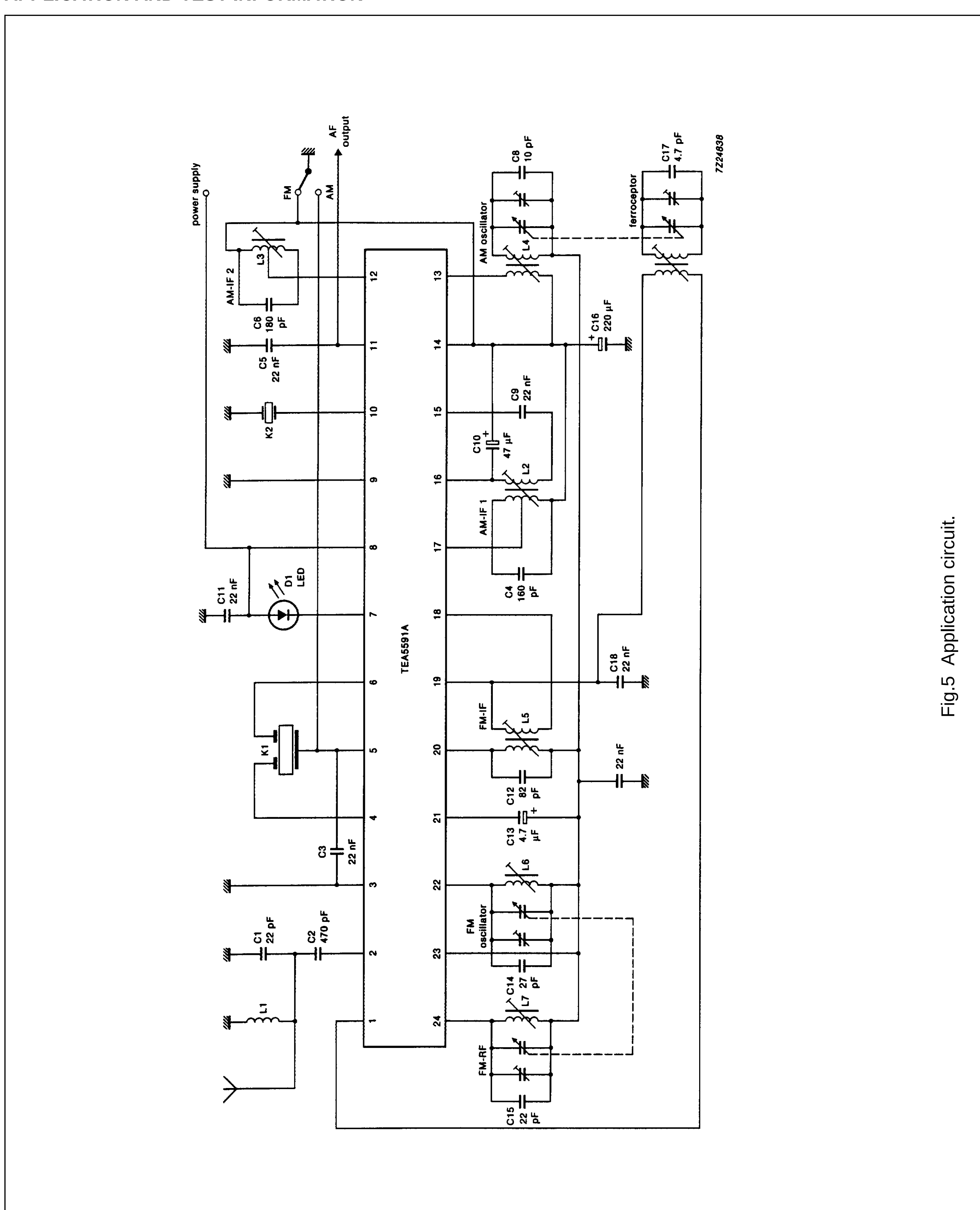
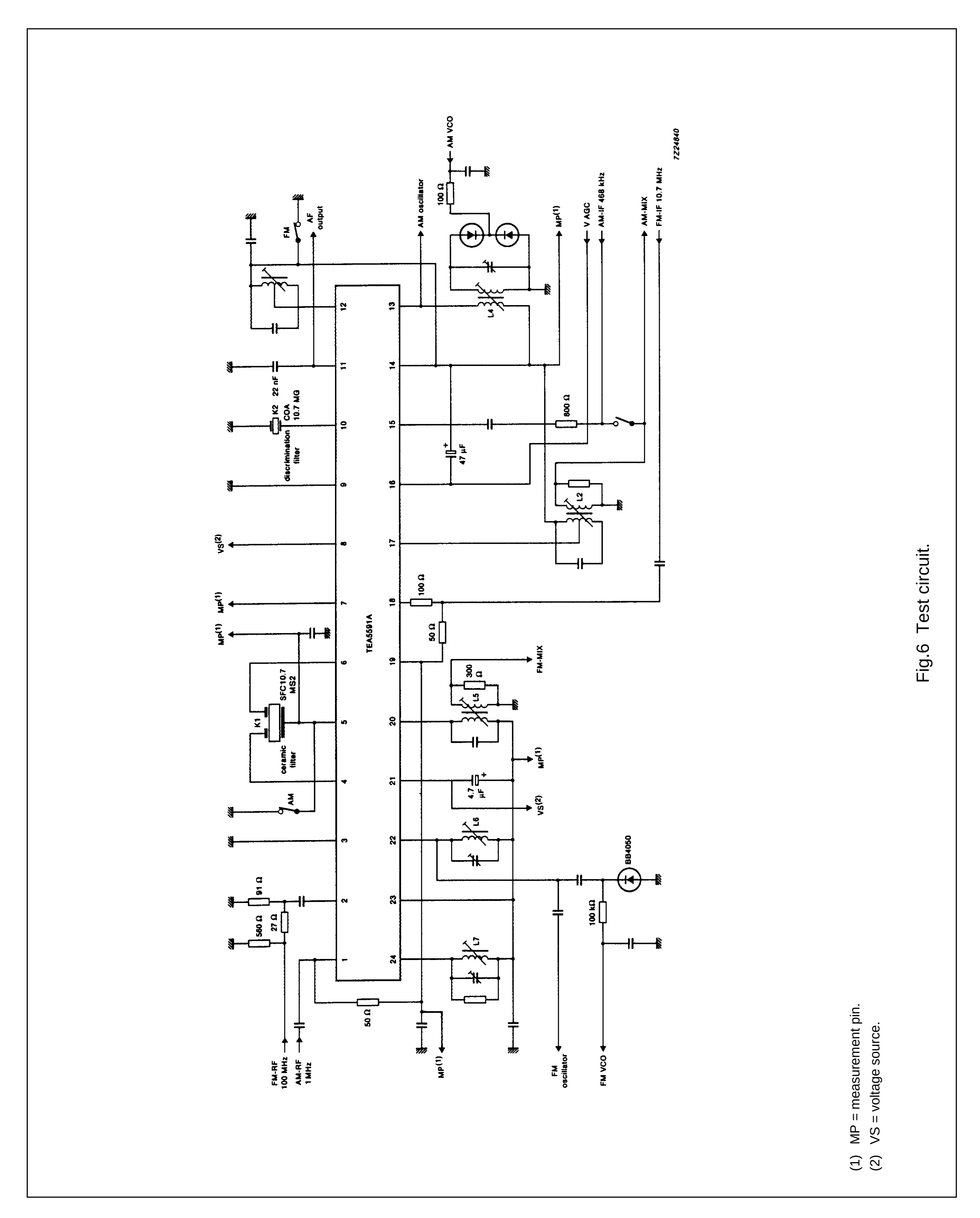


Fig.5 Application circuit.

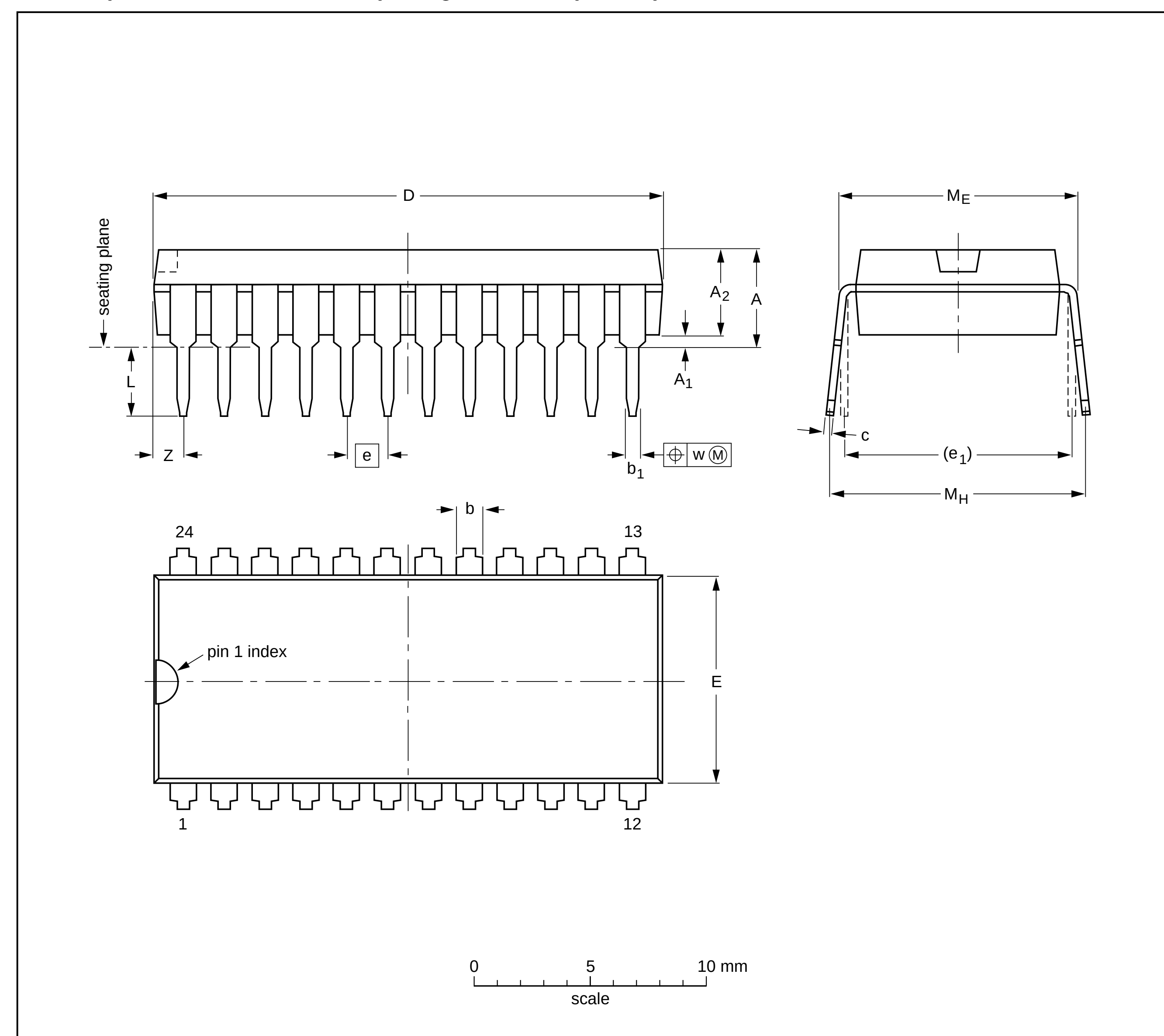


(1) MP = measurement pin.
(2) VS = voltage source.

Fig.6 Test circuit.

PACKAGE OUTLINE

SDIP24: plastic shrink dual in-line package; 24 leads (400 mil) **SOT234-1**



DIMENSIONS (mm are the original dimensions)

UNIT	A max.	A_1 min.	A_2 max.	b	b_1	c	D (1)	E (1)	e	e_1	L	M_E	M_H	w	Z (1) max.
mm	4.7	0.51	3.8	1.3 0.8	0.53 0.40	0.32 0.23	22.3 21.4	9.1 8.7	1.778	10.16	3.2 2.8	10.7 10.2	12.2 10.5	0.18	1.6

Note

1. Plastic or metal protrusions of 0.25 mm maximum per side are not included.

OUTLINE VERSION	REFERENCES				EUROPEAN PROJECTION	ISSUE DATE
	IEC	JEDEC	EIAJ			
SOT234-1						~~92-11-17~~ 95-02-04

SOLDERING

Introduction

There is no soldering method that is ideal for all IC packages. Wave soldering is often preferred when through-hole and surface mounted components are mixed on one printed-circuit board. However, wave soldering is not always suitable for surface mounted ICs, or for printed-circuits with high population densities. In these situations reflow soldering is often used.

This text gives a very brief insight to a complex technology. A more in-depth account of soldering ICs can be found in our *"IC Package Databook"* (order code 9398 652 90011).

Soldering by dipping or by wave

The maximum permissible temperature of the solder is 260 °C; solder at this temperature must not be in contact with the joint for more than 5 seconds. The total contact time of successive solder waves must not exceed 5 seconds.

The device may be mounted up to the seating plane, but the temperature of the plastic body must not exceed the specified maximum storage temperature ($T_{stg\ max}$). If the printed-circuit board has been pre-heated, forced cooling may be necessary immediately after soldering to keep the temperature within the permissible limit.

Repairing soldered joints

Apply a low voltage soldering iron (less than 24 V) to the lead(s) of the package, below the seating plane or not more than 2 mm above it. If the temperature of the soldering iron bit is less than 300 °C it may remain in contact for up to 10 seconds. If the bit temperature is between 300 and 400 °C, contact may be up to 5 seconds.

DEFINITIONS

Data sheet status	
Objective specification	This data sheet contains target or goal specifications for product development.
Preliminary specification	This data sheet contains preliminary data; supplementary data may be published later.
Product specification	This data sheet contains final product specifications.
Limiting values	
Limiting values given are in accordance with the Absolute Maximum Rating System (IEC 134). Stress above one or more of the limiting values may cause permanent damage to the device. These are stress ratings only and operation of the device at these or at any other conditions above those given in the Characteristics sections of the specification is not implied. Exposure to limiting values for extended periods may affect device reliability.	
Application information	
Where application information is given, it is advisory and does not form part of the specification.	

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